Claims

What is claimed is:

1. A sensor for detecting movement of air, comprising:

a) a flexible substrate;

b) a flexible transducer affixed to the substrate, the transducer comprising a first end and a second end;

c) a first electrical contact in electrical communication with the first end of the transducer;

d) a second electrical contact in electrical communication with the second end of the transducer;

e) a protective covering placed over at least a portion of at least one of the transducer, first electrical contact and second electrical contact; and

f) wherein the substrate is displaced when positioned in a stream of moving air, the displacement of the substrate causing flexure of the transducer and changing the electrical value of the transducer.

2. A sensor according to claim 1 wherein the protective covering substantially covers the flexible transducer.

3. A sensor according to claim 1 wherein the protective covering substantially covers the flexible transducer and the first and second electrical contacts.

4. A sensor according to claim 1 wherein the protective covering is a conformal coating.

5. A sensor according to claim 1 wherein the flexible transducer comprises a resistive ink.

6. A sensor according to claim 1, further comprising at least one flexible lead integral to the substrate.

7. A sensor according to claim 6 wherein the flexible transducer is affixed to the flexible lead.

8. A sensor according to claim 1 wherein:

a) the flexible substrate comprises a first side and a second side;

b) the first and second electrical contacts are affixed to the first side of the flexible substrate;

c) a third electrical contact is affixed to the second side of the flexible substrate, aligned with the first electrical contact, and is in electrical communication with the first electrical contact; and

d) a fourth electrical contact is affixed to the second side of the flexible substrate, aligned with the second electrical contact, and is in electrical communication with the second electrical contact.

9. A sensor according to claim 8 wherein:

a) the first electrical contact is in electrical communication with the third electrical contact by means of a plated-through hole extending between the first and third electrical contact; and

b) the second electrical contact is in electrical communication with the fourth electrical contact by means of a plated-through hole extending between the second and fourth electrical contact.

10. A sensor according to claim 8 wherein:

a) the first electrical contact is in electrical communication with the third electrical contact by means of a via extending between the first and third electrical contact; and

b) the second electrical contact is in electrical communication with the fourth electrical contact by means of a via extending between the second and fourth electrical contact.

11. A sensor according to claim 1, further comprising an air inlet-covering portion.

12. A sensor according to claim 11 wherein the inlet-covering portion is generally rectangular in shape.

13. A sensor according to claim 1, further comprising a mounting portion.

14. A sensor according to claim 13 wherein the first and second electrical contacts are affixed to the mounting portion.

15. A sensor according to claim 1 wherein the electrical value of the flexible transducer changes in proportion to the flexure of the flexible substrate.

16. A sensor according to claim 1 wherein the electrical value of the flexible transducer changes from a lower electrical value to a higher electrical value when the flexible substrate is flexed.

17. A sensor according to claim 1 wherein the flexible substrate is made of polyimide.

18. A sensor according to claim 1 wherein the sensor is positioned in the stream of moving air such that the sensor acts as a one-way valve.

19. A sensor for detecting inhalation, comprising:

a) a flexible substrate;

b) a flexible transducer affixed to the substrate, the transducer comprising a first end and a second end;

c) a first electrical contact in electrical communication with the first end of the transducer;

d) a second electrical contact in electrical communication with the second end of the transducer;

e) a protective covering placed over at least a portion of at least one of the transducer, first electrical contact and second electrical contact; and

f) wherein the substrate is displaced when positioned in a stream of moving air caused by inhalation, the displacement of the substrate causing flexure of the transducer and changing the electrical value of the transducer.

20. A sensor according to claim 19 wherein the protective covering substantially covers the flexible transducer.

21. A sensor according to claim 19 wherein the protective covering substantially covers the flexible transducer and the first and second electrical contacts.

22. A sensor according to claim 19 wherein the flexible transducer comprises a resistive ink.

23. A sensor according to claim 19, further comprising at least one flexible lead integral to the substrate.

24. A sensor according to claim 19 wherein the flexible transducer is affixed to the flexible lead.

25. A sensor according to claim 19 wherein:

a) the flexible substrate comprises a first side and a second side;

b) the first and second electrical contacts are affixed to the first side of the flexible substrate;

c) a third electrical contact is affixed to the second side of the flexible substrate, aligned with the first electrical contact, and is in electrical communication with the first electrical contact; and

d) a fourth electrical contact is affixed to the second side of the flexible substrate, aligned with the second electrical contact, and is in electrical communication with the second electrical contact.

26. A sensor according to claim 25 wherein:

a) the first electrical contact is in electrical communication with the third electrical contact by means of a plated-through hole extending between the first and third electrical contact; and

b) the second electrical contact is in electrical communication with the fourth electrical contact by means of a plated-through hole extending between the second and fourth electrical contact.

27. A sensor according to claim 25 wherein:

a) the first electrical contact is in electrical communication with the third electrical contact by means of a via extending between the first and third electrical contact; and

b) the second electrical contact is in electrical communication with the fourth electrical contact by means of a via extending between the second and fourth electrical contact.

28. A sensor according to claim 19, further comprising an air inlet-covering portion.

29. A sensor according to claim 19, further comprising a mounting portion.

30. A sensor according to claim 29 wherein the first and second electrical contacts are affixed to the mounting portion.

31. A sensor according to claim 19 wherein the electrical value of the flexible transducer changes in proportion to the flexure of the flexible substrate.

32. A sensor according to claim 19 wherein the electrical value of the flexible transducer changes from a lower electrical value to a higher electrical value when the flexible substrate is flexed.

33. A sensor according to claim 19 wherein the sensor is positioned in the stream of moving air such that the sensor acts as a one-way valve.

34. A sensor for detecting movement of air, comprising:

a) a flexible substrate;

b) at least one flexible lead integral to the substrate;

c) a flexible resistive ink transducer affixed to the flexible lead, the transducer comprising a first end and a second end;

d) a first electrical contact in electrical communication with the first end of the transducer;

e) a second electrical contact in electrical communication with the second end of the transducer;

f) a protective covering placed over at least a portion of at least one of the transducer, first electrical contact and second electrical contact; and

g) wherein the substrate is displaced when positioned in a stream of moving air, the displacement of the substrate causing flexure of the transducer and changing the electrical value of the transducer.

35. A device for delivering medication, comprising:

a) an air inlet;

b) an airway in pneumatic communication with the air inlet;

c) a sensor for detecting movement of air, the sensor being positioned in the airway proximate the air inlet such that the sensor is effective to selectively close the air inlet;

d) a reservoir for containing medication;

e) a pump/valve in pneumatic communication with the reservoir;

f) an aerosolation spray means in pneumatic communication with the pump/valve;

g) a mouthpiece in pneumatic communication with the airway and the aerosolation spray means;

h) an electrical power supply;

i) a controller portion in electrical communication with the power supply, sensor, pump/valve and aerosolation means; and

j) wherein:

i) air flowing into the airway from the air inlet displaces the sensor, changing the electrical value of the sensor;

ii) the controller portion detects the change in electrical value of the sensor and actuates the pump/valve;

iii) the pump/valve urges medication to flow from the reservoir to the aerosolation means;

iv) the aerosolation means aerosolizes the medication; and

v) wherein the air flowing into the airway is combined with the aerosolized medication in the mouthpiece for delivery to a patient.

36. A device according to claim 35 wherein the sensor is placed in electrical communication with the controller portion by means of at least one rivet.

37. A device according to claim 35 wherein the sensor is placed in electrical communication with the controller portion by means of conductive adhesive.

38. A device according to claim 35, further comprising an air shield positioned proximate the sensor to direct the air flowing into the airway from the air inlet toward the sensor.

39. A device according to claim 35 wherein the sensor cooperates with the air inlet to act as a one-way valve.

40. A device for delivering medication, comprising:

a) an air inlet;

b) an airway in pneumatic communication with the air inlet;

c) a sensor for detecting movement of air, the sensor being positioned in the airway proximate the air inlet such that the sensor is effective to selectively close the air inlet;

d) a reservoir for containing medication;

e) a pump/valve in pneumatic communication with the reservoir;

f) an electrohydrodynamic aerosolation spray means in pneumatic communication with the pump/valve;

g) a mouthpiece in pneumatic communication with the airway and the electrohydrodynamic aerosolation spray means;

h) an electrical power supply;

i) a controller portion in electrical communication with the power supply, sensor, pump/valve and electrohydrodynamic aerosolation means; and

j) wherein:

i) air flowing into the airway from the inlet displaces the sensor, changing the electrical value of the sensor;

ii) the controller portion detects the change in electrical value of the sensor and actuates the pump/valve;

iii) the pump/valve urges medication to flow from the reservoir to the electrohydrodynamic aerosolation means;

iv) the electrohydrodynamic aerosolation means aerosolizes the medication; and

v) wherein the air flowing into the airway is combined with the aerosolized medication in the mouthpiece for delivery to a patient.

41. A device according to claim 40 wherein the sensor is placed in electrical communication with the controller portion by means of at least one rivet.

42. A device according to claim 40 wherein the sensor is placed in electrical communication with the controller portion by means of conductive adhesive.

43. A device according to claim 40, further comprising an air shield positioned proximate the sensor to direct the air flowing into the airway from the air inlet toward the sensor.

44. A device according to claim 40 wherein the sensor cooperates with the air inlet to act as a one-way valve.